Investigation 1

Exploring Data Patterns

People in many professions use data and mathematical reasoning to solve problems and make predictions. For example, engineers analyze data from laboratory tests to determine how much weight a bridge can hold. Market researchers use customer survey data to predict demand for new products. Stockbrokers use algebraic formulas to forecast how much their investments will earn over time.

In several previous *Connected Mathematics* units, you used tables, graphs, and equations to explore and describe relationships between variables. In this investigation, you will develop your skill in using these tools to organize data from an experiment, find patterns, and make predictions.

1.1 Testing Bridge Thickness

Many bridges are built with frames of steel beams. Steel is very strong, but any beam will bend or break if you put enough weight on it. The amount of weight a beam can support is related to its thickness, length, and design. To design a bridge, engineers need to understand these relationships.

Getting Ready for Problem 1.1

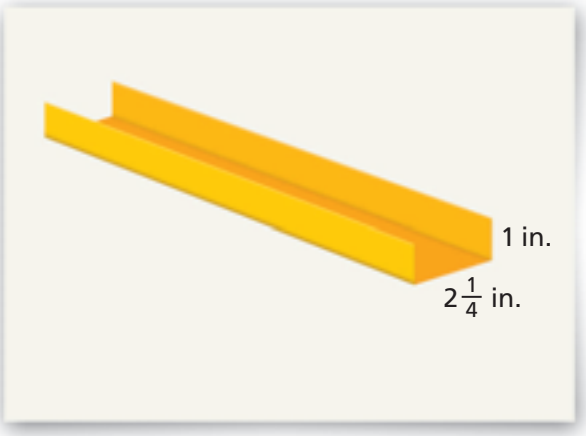
- How do you think the thickness of a beam is related to its strength? Do you think the relationship is linear?
- What other variables might affect the strength of a bridge?

Engineers often use scale models to test their designs. You can do your own experiments to discover mathematical patterns involved in building bridges.

Instructions for the Bridge-Thickness Experiment

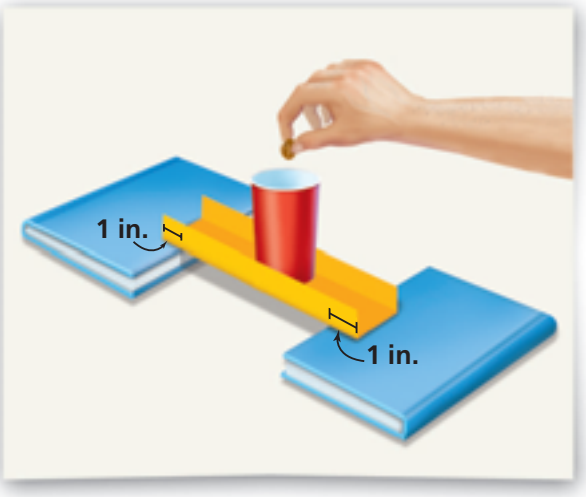
Equipment:

- Two books of the same thickness
- A small paper cup
- About 50 pennies
- Several 11-inch-by-$4\frac{1}{4}$-inch strips of paper



Instructions:

- Start with one of the paper strips. Make a "bridge" by folding up 1 inch on each long side.
- Suspend the bridge between the books. The bridge should overlap each book by about 1 inch. Place the cup in the center of the bridge.
- Put pennies into the cup, one at a time, until the bridge collapses. Record the number of pennies you added to the cup. This number is the *breaking weight* of the bridge.
- Put two *new* strips of paper together to make a bridge of double thickness. Find the breaking weight for this bridge.
- Repeat this experiment to find the breaking weights of bridges made from three, four, and five strips of paper.



Problem 1.1 Finding Patterns and Making Predictions

A. Conduct the bridge-thickness experiment to find breaking weights for bridges 1, 2, 3, 4, and 5 layers thick. Record your data in a table.

B. Make a graph of your (*bridge layers, breaking weight*) data.

C. Does the relationship between bridge thickness and breaking weight seem to be linear or nonlinear? How is this shown in the table and graph?

D. Suppose you could split layers of paper in half. What breaking weight would you predict for a bridge 2.5 layers thick? Explain.

E. **1.** Predict the breaking weight for a bridge 6 layers thick. Explain your reasoning.

2. Test your prediction. Explain why results from such tests might not exactly match predictions.

active math online
For: Virtual Bridge Experiment
Visit: PHSchool.com
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ACE **Homework starts on page 12.**